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number of species would be considerably reduced. It is remarkable that the long list includes less than half the species above named, nearly all of which appear to be very common. Further, most of those of our list mentioned in Ehrenberg's list are the least characteristic of the series. None of those named by Ehrenberg are suggestive of the forms called *D. urceolata*, *D. olla*, and *D. corona*. Many of Ehrenberg's forms are badly figured and imperfectly characterized, and his lists appear greatly extended by the same things having been described over and over again under different names.

In Wallich's able papers on fresh-water rhizopods, referring to forms from Bengal, the Himalayas, Greenland, Labrador, Nova Scotia, and England, there are indicated about a dozen species of *Difflugia*, in the restricted sense in which the genus is now viewed, and the present list includes all of these except, at most, two.

The Aeronautic Flight of Spiders.—Rev. H. C. McCook remarked that October 25, 1877, was a warm day, with a soft wind from the west; just such an autumn day as would tempt young spiderlings to essay their aerial trips. The point of the following observations was the fields back of the "Presbyterian Home for Widows," in the suburbs of Philadelphia. Stooping low, and glancing along the meadow, the eye caught the sheen of myriads of fine silken filaments glistening in the sunlight. The tops of the grass spires, and the bushy heads of tall weeds were netted together by innumerable threads, and from many points of the same, like filaments were streaming out at various lengths into the air. Numerous small spiders, chiefly orbweavers, the young of *Tetragnatha extensa*, were rising from these plants, and sailing off over the field. But the finest exhibition of the aeronautic flight was seen along the post and rail fence which divides the meadow. The tops of the posts were the favorite spots, and upon all of these clusters of young wolf spiders (*Lycosidæ*) were gathered, sometimes eight or ten in a group. The purpose in choosing these elevated spots is quite apparent, the breeze being much stronger there than close to the surface of the earth, and consequently affording much better facility for flight. The presence of a deliberate and wise volition is all the more evident from the fact that the *Lycosidæ* are ground spiders, and are rarely found in such positions as the above. They had certainly mounted to the top of the fence with the settled purpose of taking advantage of the stronger breeze, and the better "send off" which the superior height afforded. He found that the threads, spread out by spiderlings on the grass stalks, which floated quite lazily, when the stalks were broken off and lifted higher, immediately fluttered off briskly, and soon carried the little arachnid away with them. Fortunately, the posts suited the observer's convenience quite as much as the spiders', and he could easily notice the methods of the miniature balloonists.

The very top of the post was generally chosen as the point of ascent. The first position was to turn the face in the direction from which the wind was blowing. Then the abdomen was elevated to an angle of about 45°, and, at the same time, the eight legs were stiffened, thus pushing the body upward. In order to permit this movement, the claws were brought in somewhat, but not beneath the body, so that when the legs were stiffened the body stood high above the surface. From the spinnarets at the apex of the abdomen a single thread was exuded, and rapidly drawn out by the breeze, until, by reason of its delicacy, it was lost to eyesight. Four, five, even six feet of the line would at times be in view. Gradually the legs were inclined in the direction of the breeze, and the joints straightened out. The foremost pair of legs sank almost to the level of the post; and these especially, but indeed all the legs, and the entire attitude of the creature, presented the appearance of an animal resisting with utmost force and tension of muscles the effort of some superior power to snatch it away. Suddenly and simultaneously the eight claws were unloosed, and the spider mounted with a sharp bound into the air, and went careering away across the meadow, at a rate more or less rapid according to the velocity of the wind.

The utmost care was used to determine whether in this upward bound the volition of the spider had any further agency than the simple unclasping of the feet from the post. Owing to the extreme difficulty of such an observation, he could not speak with absolute confidence, but was able to satisfy his own mind that the aeronauts always vaulted upward and clear of the post at the moment of releasing their hold. That this was so in many cases, at least, he could hardly be mistaken. A similar action was frequently observed among the spiders before the final flight. Something was noticed a little like the frolicsome pranks of kittens or lambs. One would rush up to another, who thereupon would immediately change position, either by running or quickly vaulting to another part of the post. At times the leap would be made away from the post, but the buoyancy of the thread which had been exuded being insufficient to overcome the weight of the spider, instead of rising into the air, the creature returned to the post, or struck upon the adjoining rail. In these and similar movements, Mr. McCook was able to detect distinctly the vaulting action of the spider, and the eye, being thus familiarized with the movement, was less liable to be deceived in the more difficult observation of the quick spring at the time of the aerial flight. The posts and part of the rails adjoining were covered with threads adhering to the wood, and streaming out into the air. These were the result, in part, of the feints at flight just referred to; but were partly owing to another cause. The spiders, previous to flight or vaulting, attached themselves to the post in the manner common to most of their order. The apex of the abdomen was thrust down upon the surface, and the liquid silk at the same time exuded from the spinnarets was thus caused to adhere thereto. As the creature moved away, the thread was run out into line and gave the spider a firm attachment. It was a question whether this anchorage is always made previous to flight, and whether the thread is cut immediately before the ascent? The observations made all pointed to an affirmative answer; but the matter was not positively settled.

The attempt was made to follow some of the aeronauts beyond the point of ascent. The difficulty of getting the object in position relative to the sun favorable for such observation, the motion of the air which carried most of the spiders upward, as well as the rapidity of the flight, frustrated many attempts. A position was finally taken beside one of the posts of the bars, which, being opened, gave a point of observation with the back to the sun, the eye upon the object, and a fair opportunity to follow it without the delay of leaping over a high fence, which before had been between the observer and the course of the spider before the wind. Fortune favored patience, and at last a spider took flight in a line which was little higher than the face. Following the arachnid at a moderate run, with the eye held closely upon it, it was observed that the position of the body was soon reversed, that is, the head was turned in the direction toward which the wind was blowing, instead of toward the point from which it blew, as before the ascent. Thus the long thread which streamed out above the aeronaut inclined forward, and at the top was in advance of its head. It was also observed that the legs were spread out, and that they had been united at the feet by delicate filaments of silk. The action by which this spinning work was accomplished was not noticed, owing to the smallness of the creature, the rapidity of its movements, and the difficulty of such an exceptional mode of observation. But the fact was noted. The reason naturally suggested for it is the increased buoyancy resulting from the increased surface thus offered to the resistance of the air.

The spider was followed for a distance of eighty feet, when it gradually settled downward upon the meadow. Before, or rather during this descent, a small, white, flossy ball of silk was seen accumulating at the mouth of the spider, which, with the peculiar motion of the forefeet, palps, and mandibles, at once suggested the drawing in of a thread. This behavior is not infrequent with spiders under other circumstances; but it became especially interesting at that moment, for at once it suggested an act of volition on the part of the lycosid, by which it, in a measure at least, might control its descent. Evidently the shortening of the overhanging thread operated like the furling of sails upon a vessel, and decreasing the motion of the spider, increased the influence of gravity upon the body, which thus sank toward the ground. At the same time, the diminution of surface of the thread above, and the increase of bulk at the mouth, decreased the buoyancy of the whole, and allowed the creature to fall. Exactly the same effect was thus produced by the spider-aeronaut, and by a strikingly analogous mode, as the human aeronaut accomplishes when he contracts the surface of his balloon by causing the inflating gas to escape.

Some observations were made at the same time upon the aerial flights of several species of small orbweavers. These were stationed upon the tall grasses and weeds, from which innumerable cords of spider-silk were streaming, and upon which similar threads were twisted and meshed by the eddies of the wind, and the passing of the spiderlings from point to point. The attitude of most of these was one of expectation. Only two were observed in actual flight, and one of these was assisted. The nearness to the ground and the shelter of the surrounding herbage, may have retarded the process. However, this greater deliberateness is quite in harmony with the phlegmatic orbweavers, just as the energy of the *Lycosidæ* in mounting the fence, and their haste to be off, is characteristic of that group, who are, indeed, in their vigorous, stirring activities, quite typical Americans. The little orbweavers were hanging upon the lower part of the floating strings near the point of attachment to the grass. Their backs were downward and their heads outward or toward the free end of the thread. The first, second, and fourth pairs of legs were stretched along the thread, and the third and shortest pair were held off, curved, the feet apparently united to the main thread by taut filaments. This position, so far as could be determined, was maintained after flight. In some cases a series of two or three puffs or pellets of floss were gathered around the thread between its free end and the spiderling. They were generally cone-shaped, the apex toward the spider. In form they were not unlike the pellets which one used to see gathering upon the roll of wool as it passed from the fingers of our maternal ancestors into the whirling "flyers" of an old-fashioned spinning wheel. Perhaps they may have been wrought by a similar process, the twisting of the loose thread through the action of the wind, and the counteraction of the spider.

The above observations were the most complete and satisfactory which Mr. McCook had been able to make, but he referred, in further illustration and confirmation of these, to the results of observations and experiments of several previous years. In the closing days of October, if the weather have the usual mildness of that period, these aerial flights may be seen from almost any open spot of country-side. The 29th of October, 1875, was especially remarkable for the exhibition of this habit. All the young of the spider-fauna seemed to be afloat. It was like the simultaneous outbreaking among our children of the annual fury for special games, marbles, tops, jumping rope or hoop. The air was filled with floating filaments of spinning-work. Passing along the public squares of Philadelphia, Mr. McCook arrested and examined some of these; the prevalent, indeed it might be said, the unvarying type, was the single thread, long, with a flossy tuft of irregular form, but commonly hammock-shaped, at or near the middle of the line. A small dipterous insect was found entangled upon one of these threads. Fairmount Park was filled with these excursionists. All day long the filaments were floating across the Schuylkill River, entangling with the decks and smoke-stacks of passing steamboats, and with the persons of passengers and crews. One of the latter caught a number of the threads, on which he found small spiders, and on three threads little flies. The next day Mr. McCook saw some of these attenuated balloons float across the river at a height of from 60 to 70 feet, and entangle with trees upon the high bluff. The temperature, however, had fallen several degrees, and comparatively few of the aeronauts were afloat. The floating filaments while in motion preserved generally a crescent or horse-shoe shape, the "horns" or forks nearly equal in length or not greatly unequal, and pointed toward the direction of the wind. At or near the point of curvature or divergence was the puff of floss or "basket" as it might, perhaps, be called.

Mr. McCook, in conclusion, referred to experiments which he had made afield and from his study-window with young spiders, particularly the young of *Agalena nævia*, the speckled tubeweaver. When let loose into the air from the finger-tip, the spiderlings floated out by a single thread which was always and instantly first attached to the finger. At first, the head was outward, the abdomen being toward the hand, from the apex of which the long superior spinnerets diverged. Presently the little creature turned and cast out a thread behind, when, if permitted, it would usually clamber up the original thread to the finger. When this was broken off, the spider, seated midway of the two filaments, floated off and outward, and was lost to sight. Again, by an eddy of the air, the thread would be thrown backward and upward and catch against the wall upon which the little voyager would anchor. At other times, much to his surprise, after the thread had been quite lost to view, and the spider was supposed to be far away upon its flight, it would descend, as from the clouds, and send out its silken grapnels against the observer's cheek or nose. The will of the little spider seemed to have no control over these movements, which apparently were always wholly at the mercy of the wind. However, the manner of accomplishing the aerial flight by means of the buoyancy of a single thread, or rather of two threads united at or near the middle, was quite in accord with the methods above described. Reference was also made to the remarks of other observers which were compared with those here given.